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Received Apr. 27, 1897

Gerrit Altwood.

THE

GOLD FIELDS OF VICTORIA;

WITH

STATISTICS, GATHERED FROM THE VARIOUS DEPARTMENTS OF THE VICTORIAN GOVERNMENT, & OTHER SOURCES;

SHOWING

AN IMMENSE OPENING FOR THE SAFE INVESTMENT OF CAPITAL IN THE AUSTRALIAN GOLD MINES.

BY

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"The men who begin with speculation and end with facts, begin at the wrong end; the firmest materials should be in the foundations."—SIR HUMPHREY DAVY.

Experto crede.

LONDON:
EFFINGHAM WILSON, ROYAL EXCHANGE.

1867.

PREFACE.

THE writer has been in the employ of the Victorian Government for many years, and, desiring to visit his native country, after spending the best portion of his life in the Colonies, obtained twelve months' leave of absence from his duties.

Knowing, as he does, the immense areas of unoccupied auriferous country that exist throughout Victoria, as also that thousands of miners in Great Britain are compelled to live in idleness when they might be profitably working the Victoria mines, he (the author) concluded to write this pamphlet whilst on the voyage from Melbourne to London.

Any theory touched upon, has been borrowed from others, as the writer has neither the time nor inclination to enter into discussions on the formation of quartz lodes. *The facts he vouches for.*

A desire to benefit the land of his adoption, as well

as to plan an outlet for the employment of some of the superabundant capital and labour of this country, are the reasons for the issue of this pamphlet.

Persons desiring to know more of the Victorian Mines than is here given, may communicate with the writer, addressed to the care of C. H. FIELDER, Esq., 35, Bucklersbury, London, E.C.

August, 1867.

THE

GOLD MINES

OF

VICTORIA.

Although doubts exist as to the exact date of the discovery of gold in Victoria, I think the best evidence shows that it was first found in the Pyrenees, a mountainous region, about 100 miles W.N.W. of Melbourne, in 1849. Long before this, however, it was *said* that gold was to be found in Australia. Indeed, so far back as 1846, Sir R. I. Murchison, the eminent geologist, was so impressed with the belief that gold would be obtained in that part of the world, that he advised the tin miners of Cornwall to emigrate to that country, and mine for gold as they mine for tin in their own county.

The discovery of the precious metal in California induced Mr. Hargreaves, a colonist of New South Wales, to visit the new Eldorado, with a view to participate in the search for the valuable ore. Mr. Hargreaves possessed some knowledge of the geological features of New South Wales, and was at once struck with the similarity of the Californian rocks to those of portions of New South Wales. He returned to his adopted home, and

was successful in his search for gold. The discovery of gold mines in New South Wales led to the opening of the Victorian Gold Fields. Although gold was found at Clunes in March, 1850, it was not till after the discovery of gold in New South Wales that attention was directed to the Victorian mines—since become the most valuable the world has ever known.

On the 10th of June, 1851, gold was found near Burnt Bank, on a tributary of the Loddon; on the 20th of July, at Mount Alexander; on the 8th September in the same year, at Ballarat.

The Government of the Colony of Victoria first issued licenses to mine on the 1st of September, 1851. The discovery of rich gold-fields led to the usual results. The farmer left his plough; the shopkeeper his counter; the lawyer forsook the courts; and even some of the clergy forsook their sacred calling in order to participate in the scramble.

Unfortunately, it is generally understood in England and elsewhere, that gold in Victoria occurs in shallow alluviums, and that these are being gradually exhausted. It is, indeed, a fact that the shallow alluviums are being gradually exhausted, but this class of mines bears only a very small proportion to the whole. An examination of the geological sketch-map of the Colony of Victoria, prepared under the direction of Mr. Selwyn, the government geologist, will at once convince the most prejudiced mind of the fallacy of such a notion.

The immense areas of deep auriferous tertiaries, together with the numberless quartz veins (the matrices of the alluvial gold), are practically inexhaustible. Mr. R. B. Smyth, the Secretary of Mines for the Colony of Victoria, in his able pamphlet, prepared for the Intercolonial Exhibition, 1866, says, "We have room for

four times the number of persons now actually engaged in mining; and if the yield of gold has fallen off, it is because the numbers engaged in mining have decreased. Gold mining is laborious, often uncertain, and frequently involves hardships and suffering which none but the strongest are capable of bearing without injury, and it is not surprising that many persons who left their professions and trades in the hope that they would rapidly acquire a fortune on the gold-fields, have resumed their former pursuits."

It is not my intention to discuss the theory of the distribution of gold; one fact is worth a thousand speculations, and sometimes throws theories to the wind, however carefully they may have been deduced. I think I shall have little difficulty in proving, by statistics and evidence of other kind, that the theories advanced by men of the highest standing in the science of geology are utterly erroneous. If the gold miner had looked to the geologist as his guide, the position of both California and Australia at the present moment, as gold-yielding countries, would be anything but good.

The Victorian Government, during the year 1856, appointed a Commission for the purpose of reporting on the state of the gold mines. The result was, that, guided evidently by pre-conceived notions, they reported that mining for gold to great depths in quartz reefs would be unprofitable.* The injury done to the mining interests of the Colony by this report can only be appreciated by those on the spot. The fallacy of such deductions is now so clearly demonstrated that the practical miner only wonders that he should have been led away by such false doctrines.

* I think I am correct in saying that the limit was 60 feet (10 fathoms) below the surface.—R.L.M.K.

The *alluvial* gold was first discovered on the surface around the hill sides, and was gradually traced into deeper ground, until, at the present moment, the beds of the ancient rivers are being mined at depths varying from 100 to 500 feet. The most recent deposits are due to the continued denudation of the rocks in the immediate neighbourhood of such deposits, to forces in fact, now in operation. These deposits result either from the action of the modern stream on the older tertiaries, or the gradual wearing away of the auriferous quartz veins. The source of the modern deposit can be easily ascertained; as, in the former case, the gold is much water-worn, and, in the latter, appears as though only lately separated from its matrix; indeed, in many of the shallow workings most of the gold still adheres to the quartz rock, and requires to be separated from the substance surrounding it, prior to being fit for the market.

The older deposits are found in what are called deep *leads;* these exist in various parts of Victoria, at Guildford, Taradale, Malmsbury, Creswick, Daylesford Ararat, Sandhurst, Smythesdale, Beechworth, Indigo, Maryborough, Ballarat, and other places. The labour required to open the gold mines on these *leads* is immense. The basaltic rocks, of which there are, in some cases, three and even four separate layers or deposits, have to be gone through before the bottom (bed-rock) is reached. It takes all the science and skill of the miner and mining engineer, and sometimes years of labour, to penetrate these rocks. Nor is the extraordinary hardness of the rock the greatest difficulty the miner has to contend with; between the layers of basalt, there sometimes occur layers of drift-sand, to keep back which, the most indefatigable exertions are

required. The following section of the White Horse *lead* Ballarat will give an idea of the nature of the sinking above referred to :—

Surface soil	2	feet
Basalt, clay and soil	10	,,
Basalt	54	,,
Clay	37	,,
Basalt	79	,,
Clay	46	,,
Basalt	45	,,
Black clay	12	,,
Brown clay	16	,,
Drift and gravel	7	,,
Wash dirt	11	,,
Total ...	319	feet

Although the labour is great, the reward is commensurate. I cannot do better than quote from Mr. Smyth's pamphlet; he says,—"When the first difficulties are overcome, when the miner reaches the *washdirt*, his reward is great. For years he may have been contending with hard rock, with loose, wet drift, worse than rock, or spending his time uselessly in driving galleries in the wrong direction, but, when at last he touches the gutter, he finds wealth. Gold, which has been hidden for perhaps millions of years; gold, which has been purified by contact with water and air, whereby the base metals have been oxidised and carried away, is presented to his view. Every shovelful of earth is valuable, and not a handful of it but gives evidence of great forces, which, during the lapse of ages, have ground down and washed the detritus of quartz reefs and slates."

The following return of the value of the yield of gold from a few of the claims (alluvial) at Ballarat, is instructive :—

Sir W. Don Co., from Novr. 1865 to 6th Sept. 1866	£62,375	6	8
Redan Co., June 1861 to Sept. 1866 ...	438,289	7	11
Band of Hope, to 6th Sept., 1866 ...	387,138	8	5
Albion Co., Dec. 1861 to 6th Sept., 1866	175,420	5	0
St. George Co., July 1865 to Aug., 1866	69,948	18	4
Roh-i-noor, Nov. 1859 to Sept., 1866...	390,990	0	0

The mines above specified, together with hundreds of others, have repaid the original subscribed capital over and over again. Taking the first on the list, for instance; from September 6th, 1866, to March 19th, 1867, the yields have been such as to give (with the gold obtained from November, 1865, to September, 1866) dividends amounting to £88,000 on 2000 shares, on each of which £1 has been paid, and the stock, costing the proprietors only £2000, is worth £112,000 in the Melbourne market.

It may well be said that the reward to the persevering gold miner is "great." The Sir W. Don Company pays about £1500 per cent. per annum on the subscribed capital. It must not be forgotten, however, that the Sir W. Don proprietors were successful in their search to an unprecedented degree.

A list of the yields from some of the principal alluvial mines in Victoria for the month of March, 1867, will give an idea of the extent and productiveness of that class of mines.

	Ounces.	Dwts.	Grs.
Albion G. M. Co., Ballarat	1443	10	0
Buninyong G. M. Co., Buninyong ...	963	3	0

	Ounces.	Dwts.	Grs.
Buninyong New G. M. Co., Buninyong	549	0	0
Ballarat Tunnelling Co., Daylesford...	177	19	12
Band of Hope G. M. Co., Ballarat ...	2562	15	0
Cosmopolitan Co., Ballarat	270	18	0
Duke of Cornwall Co., Durham ...	57	0	0
Inkerman and Durham Co., Ballarat	322	7	0
Leviathan Co., Buninyong	256	0	0
Garibaldi G. M. Co., Durham	147	11	0
National G. M. Co., Buninyong ...	353	10	0
Nelson and Wellington Co., Ballarat	611	16	0
New Garibaldi Co., Ballarat	82	19	0
Prince of Wales G. M. Co., Cobblers	3162	8	0
United Red Jacket Co., Ballarat ...	826	9	12
Royal Saxon G. M. Co., ,, ...	461	7	0
St. George United Co., ,, ...	1112	0	0
Sir Wm. Don G. M. Co., ,, ...	2911	14	4
Working Miner's Co., ,, ...	1183	15	0
Great Gulf G. M. Co., ,, ...	737	13	0
Enfield G. M. Co., Buninyong	188	11	0
Newington G. M. Co., Ballarat... ...	472	0	0
Western Freehold Co., ,, ...	471	4	0
Lennon's Paddock, Ballarook	109	17	12
Lady Don G. M. Co., Ballarat	102	0	0

Mining for gold in the tertiaries is much better understood in Victoria than *quartz* mining; whilst in most instances the alluvial mines are well managed, the quartz mines are subject to a system of bungling, almost incomprehensible. This is, perhaps, easily accounted for; in the one case, the *lead* being found, the work becomes comparatively easy, as it consists in excavating horizontal chambers, and securing the ground, or, more properly speaking, taking away the auriferous wash,

and propping the superincumbent earth and rocks. In mining quartz reefs (lodes) all the knowledge possessed by a tin or copper miner is necessary in order to carry out the work in a proper manner. I will refer to this more fully hereafter, as it is my intention to dwell more on the *quartz* than on the *alluvial* resources of the Colony of Victoria. It may not be uninteresting, however, to show the amounts paid in dividends by some of the "alluvial" companies. The following I have taken from the share list, as it appears in *Dicker's Mining Record*, and acknowledged by the Melbourne Stock Exchange.

Name of Company.	Amount (said to be) subscribed.	Dividends paid.
Concordia	£2,400 0 0	£10,400 0 0
Defiance.....	54,060 0 0	71,084 0 0
Extended Sons of Freedom	26,644 16 0	20,440 16 0
Koh-i-noor Co.....	96,000 0 0	127,280 0 0
Prince of Wales Co.	115,200 0 0	39,000 0 0
Red Jacket Co.....	107,800 0 0	37,200 0 0
Sir Wm. Don Co....	2,000 0 0	88,000 0 0
Cosmopolitan Co. ...	46,209 0 0	130,640 0 0
Band of Hope Co.	256,000 0 0	*262,400 0 0

The amounts appearing in the middle column are only *nominally* subscribed. Most of the mines, prior to being placed into the hands of public companies, were held by working miners and others, and, on registering

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* In addition to the sum of £262,400 paid in dividends, *hundreds of thousands of pounds* (the result of the gold obtained) have been spent in opening the mine. One shaft cost £125,000! and its sinking was paid for entirely out of the proceeds of the mine.

them under the *Limited Liability Act*, placed their own value on their property, hence they appear in the public share-list with a large (nominal) paid-up capital. I question if *one-tenth* of the amount shown as "subscribed" capital in the above list has been paid.

NUGGETS FOUND IN THE ALLUVIUM.

The number of large nuggets which have been found in the Colony, and respecting which information is available in the records of the mining department, is 98, and the aggregate weight is 36,218 oz. 2 dwts. 22 grs., showing an average of 369 oz., 11 dwts., 11 grs. Some of these weighed nearly 3000 oz., and some as little as 5 dwts. It must be surprising to those who have carefully considered the question, that the number is so small; but it must be remembered that a great number of nuggets have been found which are not included in this statement, and respecting which nothing certain is known. The formation of nuggets, strange to say, has been accounted for in various ways. Numerous theories have been propounded to account for their origin. Some suppose that they have *grown* in the alluviums, getting larger day by day, and that they have increased by successive layers of gold being imposed on a solid nucleus! This may cause the reader to smile, but nothing affecting such subjects, which is advanced by persons of intelligence, is fairly a subject of ridicule. The fact that nuggets in general are almost free from impurities is, in the minds of some, an argument against their origin in common with small particles of gold in

quartz veins, and, again, it is suggested that large pieces of gold are not *usually* found in veins.

Mineralogists state that the purity of alluvial gold is due to its having been exposed for long periods to the action of water and atmospheric air, whereby the silver, copper, iron, &c., which are alloyed with the gold in the veins, have been decomposed and removed. This explanation is so reasonable, having regard to the constituents of the minerals usually associated with gold in the alluviums, that it is almost startling to find any person bold enough to doubt the sufficiency of it.

Large pieces of gold have been found in quartz veins, and scarcely any large nugget has been unearthed which has not had a great quantity of quartz adhering to it or intermixed with it,* and surely it is but reasonable to conclude that nuggets have been formed in the veins in the same manner, and probably at the same time as

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* The *hundredweight of gold,* discovered on Dr. Kerr's station, in New South Wales, was taken from a vein which cropped out on the surface. "The largest of the blocks was about a foot in diameter, and weighed 75 lbs. gross. Out of this piece 60 lbs. of pure gold were taken. Before separation it was beautifully encased in quartz." The "Blanche Barkly" nugget contained 2 lbs. of quartz, clay, and oxide of iron. Two large nuggets found at Dunolly, which weighed 2952 oz., presented gold, distributed through a rust-coloured matrix. The "Lady Hotham" nugget contained much quartz and sulphuret of iron. The large nugget, found at Canadian Gully, Ballarat, showed gold, finely intersected with quartz. Every nugget, whether large or small, which has not presented indications of having been very much worn, has borne with it proofs that it had been broken out of a vein. The most careless examination of any large piece of gold would satisfy the observer that it had not been formed differently from smaller pieces but whatever is uncommon, is, in the minds of some, marvellous.

other smaller pieces of gold. That we have not found as many large pieces of gold in the veins as in the alluviums is just what might have been expected. Every superficial foot of auriferous drift represents many thousand feet vertical of veins; and, until we shall have explored the existing veins completely, and ground them down, and worked them to a depth equal to that operated on by the denuding forces in past ages, we cannot say whether or not the proportion of nuggets found in the alluviums is in excess.

QUARTZ MINING.

Great as are our resources in alluvial gold, and long as it will take to rob the pre-Adamite river-beds of their long-stored treasures, the relation of this class of mines to the quartz, reefs is almost similar to that of the tin streams of Cornwall to the permanent tin lodes of that county. A glance at the geological sheets of portions of Victoria, so ably prepared by Mr. A. R. C. Selwyn and his staff, will give an idea of the innumerable auriferous reefs or lodes traversing the upper and lower Silurian rocks. Writing on the subject, Mr. Selwyn says, "The total area occupied in Victoria by lower palæozoic auriferous formations, with their associated plutonic rocks, including the districts in which the overlaying tertiaries and recent deposits do not exceed 350 feet, cannot be estimated at less than 41,813 square miles, deducting 11,465 square miles, occupied by granite and other

plutonic rocks that are not, or only partially, auriferous, *we have an area of* 30,348 *square miles, in any part of which there is a possibility of remunerative gold deposits being found,* either in veins or in alluvial deposits. The actual area mined upon is stated, in the mineral statistics of Victoria, 1865, to be $725\frac{77}{120}$ square miles.

"The above facts, viewed in connection with the large extent of country over which gold-bearing quartz veins have been discovered, and the comparative limited extent of the different workings, afford good ground for the inference that the gold mines of Victoria may, with the requisite and judicious combination of skill and capital, and lessened cost of production, *be made as permanent a source of wealth as the tin, copper, or other mines of Great Britain.*"

My object in writing this, being for the purpose of showing that a large field is open for the profitable investment of capital in the Australian gold mines, it is manifestly my duty to produce evidence to support my opinion.

Mr. R. B. Smyth, in his pamphlet, refers to "auriferous quartz veins" as follows, "Numerous quartz veins are found in all those parts of the Colony where the schist rocks appear on the surface, and they are met with also, cutting the older sedimentary rocks, under tertiaries. The strata in which they occur present generally a low degree of metamorphism, and, in many places, are unaltered. The veins vary in thickness from an inch to fifty feet, and some, almost as thin as the paper on which these words are printed, intersect rocks containing palæozoic fossils, but the delicate structure of the casts is not altered, nor are any of the inter-spaces filled with quartz.

"If we collect the magnetic bearings of all known

auriferous reefs, we find that the northerly and southerly veins, with rare exceptions, follow the strike of the rocks which they intersect, and are confined within the lines of oscillation of the magnetic declination. The easterly and westerly veins conform to the same law. This is true of the quartz veins, intersecting the palæozoic rocks, but there are auriferous quartz mines in granite, where this rock abuts on metamorphosed slate, which appear to be of more recent formation; and, lately, veins of quite remarkable richness, have been discovered, lying as flat and nearly parallel bands, in dykes of syenetic diorite.*"

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* The following extract, from a report on the gold workings in these dykes, by C. D'Oyly H. Aplin, Esq., Acting Director of the Geological Survey, will be read with interest. The report is dated 26th January, 1864.

"On this spur, at Wood's Point, at a short distance above, and overlooking the township, is the celebrated 'Morning Star Reef,' from which, for months past, returns, appearing to be almost fabulous in amount, have been derived.

"This so-called 'reef,' but to which the term is manifestly inapplicable, includes a series of three, and possibly more, horizontal and approximately-parallel veins of auriferous quartz, traversing a dyke of syenite, about 100 yards broad at the surface, and widening downwards. The direction of this dyke is about N. 55 deg. W., the general direction or strike of the sandstones and slates of the district N. 45 deg. W. (magnetic). Their dip, as seen at the eastern wall of the dyke, is about 80 deg. to the west; the general dip of the beds, wherever I could see sections, being at very high angles from 75 deg. to vertical.

"The rock, constituting the dyke, is a mixture of hornblende and felspar, with but little quartz, and occasionally mica; it might, perhaps, be more correctly termed a *syenetic diorite*. From the surface downwards, as deep as the workings extend, it is in a decomposed state, and no great difficulty is experienced in sinking or driving in it. A good deal of slabbing, however, is required for both. In the lowest

"The surface of the Colony, it has been stated, has been but imperfectly explored, and it is probable that gold will be found here, as in America, in places where,

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tunnel (Hurley & Co.'s) this rock, where first struck, and for about fifty or sixty feet beyond, is found to be very hard, and in an almost unaltered condition; this is the case also with large boulders that are found loose in the soil on the flank of the spur. The soil derived from its decomposition is of a very rich character, and vegetables of all kinds are said to grow luxuriantly in it.

"Crossing this dyke at different levels, some sixty or seventy feet apart, are three horizontal bands or veins of quartz, each of which is at present being worked by different parties, whose claims are all registered as being on the same reef—the Morning Star. This may hereafter give rise to some difficulty in the application of the mining bye-laws, should they ever require to be appealed to, in case of dispute.

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"The quartz veins, though horizontally traversing the dyke, are more or less undulating in their course. They vary in thickness in different parts of the workings, from one to two feet, to as much as twelve, but in the latter case are split up into a mass of thin, ramifying, and reticulating veins, enclosing between and amongst them portions of the syenetic mass through which they have penetrated. The whole thickness, however, is sent to the mill to be crushed. They abound in crystals of quartz, many of them very perfect in form, and beautifully grouped together. Iron pyrites is also abundant, and, in Drysdale and Co.'s claim, sulphide of antimony had been met with in tracing the extension of the veins they are working into the adjacent schist rocks.

"As the quartz veins approach the walls of the dyke, they seem to have a tendency to split up and become attenuated; they can, nevertheless, be seen passing obliquely downwards into the slates, but, except in Drysdale and Co.'s claim, do not appear to have been followed further. In Hurley and Co.'s claim, I noticed, however, that the quartz, in a solid mass two feet thick, continued its course horizontally, cutting directly across the slates, but had only been followed as yet through about four feet into them. Mr. Hurley informed me that at this spot the character of the quartz was rather improved than

if the old theories relative to the modes of occurrence of gold were correct, it ought not to exist.

"Many theories have been advanced relative to the mode in which veins have been impregnated with gold.

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otherwise, and, in Drysdale and Co.'s claim, the quartz traversing the slates, though much attenuated in thickness, was exceedingly rich in quality.

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"The richness of the quartz may be judged from the fact communicated to me by Mr. Colin McDougall (a partner in one of the claims on which the machinery is erected, and in the prospecting claim), that, from quartz crushed since June last in a small machine of eight stamps, and driven by water-power, a return of between £40,000 and £50,000 has been realised; 1200 oz. was the return from the same machine for the week preceding my visit, and 1272 oz. for the week following. In Drysdale and Co.'s, McDermott and Co.'s, and the Hope Company's claims, all situated adjacent to each other on the before-mentioned dyke, the quartz has proved to be exceedingly rich, but McDougall and Hurley are the only parties who have crushing machinery erected, and at work; their claims, therefore, are the only ones that may be said, at present, to be producing returns.

"About two-and-a-half miles from Wood's Point, along the spur, dividing the left-hand branch of the Golburn from some small tributaries of the right-hand branch, a new reef, called the *Waverly*, had been discovered about a fortnight before my visit; and, before I left, no less than fifteen claims in succession, occupying a linear extent of more than a mile, were reported to have struck gold. This reef, so far as I was able to judge from the shallow depth to which any of the workings had reached, presented features still more singular than those of the Morning Star. The shaft which I examined (No. 1, North), exhibited the following descending section:—First, about twenty-six feet of a decomposed rock (more trappean than granitic), of a reddish or reddish-brown colour, mottled with spots of pale, dirty yellow, and containing crystals of white mica. Then followed a seam, or bed, of auriferous quartz, six feet thick, and about five feet wide (the breadth of the reef). This was succeeded, or underlaid, by twelve feet of a brown-coloured rock, of the same texture and appear-

The eminent geologist, Sir R. I. Murchison, has suggested that the rocks were impregnated with it after the miocene period, and but 'a short time before the epoch when the powerful and general denudations took place which destroyed the large extinct mammalia.' It is presumed, therefore, that all the drifts, formed *previous* to the miocene period, would be non-auriferous, and nat during immense periods of time the denuding forces would be operating on veins which contained no gold. It is not possible, in a short paper, to discuss this theory, but to neglect it altogether would be to deal unfairly with the material interests of the country. There are large areas in this Colony occupied by miocene and mesozoic rocks; and if there are any grounds for believing that these strata are not barren, they should be stated.

"With the knowledge of Sir R. I. Murchison's labours —devoted almost exclusively to geological investigations for a great many years—the writer believes he is not wrong in supposing that that geologist will reconsider an important question if new facts be stated in regard to it.

"If we examine the quartz veins at Castlemaine and at Clunes, we find that very minute particles of gold—quite invisible to the naked eye, and hardly to be seen with a powerful microscope—are disseminated through masses of hard, dense quartz, showing conclusively, it is suggested, that the gold and the quartz were deposited

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ance as the first mentioned, but more micaceous. Beneath this was auriferous quartz, which had only been penetrated to a depth of two feet, and in which gold was plainly visible, though in fine particles. The quartz terminated, like the decomposed trappean rock, abruptly at the walls, and thus presented even more strikingly than the Morning Star the appearance of a horizontal *bed*."

in the vein at the same time. Are there any forces known to the chemist which would be adequate to effect the dissemination of metallic gold in such a medium?

"It is certain that these veins were formed long prior to the mesozoic period, and the proofs are to be found in the granitic districts.

"This statement is, however, in one sense unsatisfactory. Geologists, at a distance, may conclude that inferences have been wrongly drawn from facts accurately stated.

"In strata, which it is believed are of miocene age, gold has been found. At Tea Tree Creek, not far from Steiglitz, some 350 feet below the auriferous pliocene gravel, fine gold has been obtained. The well-known mining engineer, Mr. R. M. Sergeant, of Ballarat, thus states the fact:—'Two days after I wrote to you, we came on a floor of compact sandstone grit, about one foot in thickness, and then fine drift, with *flattened*, well-washed, boulders, or pebbles of quartz. This drift contained large quantities of pyrites. We sunk in it eight feet, and again struck black clay, with large pieces of trees, &c., and a *little fine gold*.'

"Gold has been found, it is well known, in Nova Scotia in rocks of carboniferous age.

"The Rev. W. B. Clarke, whose opinions on all questions relating to gold-bearing rocks are received by every geologist with respect and confidence, has stated, in a letter, addressed lately to the editor of *Dicker's Mining Record*, that gold has been 'detected at the Mint (Sydney) from even secondary rocks of Queensland;' and he says, 'I conceive that there is nothing extraordinary in urging the possibility of gold being found in the miocene drift.'

"As already stated, there is not space here for dis-

cussion, nor even for a complete statement of facts; but it may not be entirely without interest to know the opinions of the writer on these questions. Abundant opportunities of acquiring information, and careful thought, have led him to take a practical view of these questions. The results may be stated thus:—Our quartz veins were formed prior to the mesozoic epoch. Gold was deposited in the greater number of veins contemporaneously with the quartz; but all the veins were not formed at the same time, nor in the same way.

"Gold will be found in all drifts and strata which have been derived from the palæozoic rocks; those strata of marine origin, however, from the nature of their formation, will rarely contain gold in such a form as to remunerate the miner—the gold will exist in such fine particles, and will be so distributed in the rocks, as to be with difficulty recovered. Gold is found plentifully in modern drifts, because the rocks, forming the drifts, have not generally been much moved.

"Gold is deposited every day in all rocks, of whatever age, which are below what is called "the water-line."

"In obedience to laws which are not understood, gold will be accumulated in veins and fissures, rather than in the lines of bedding of the boundary rocks.

"Gold exists as an ore.

"The yield of gold will *increase* with the depth below the 'water-line;' but not, probably, to a great degree.*

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* The way in which gold is distributed in rocks has led to many mistakes. If it were as plentiful as the ores of copper, or lead, or iron, and not more valuable, or if it were as easily traced as a bed of coal or lignite, we should hear of few controversies regarding its mode of occurrence. Gold, in great quantities, is not found every day in certain strata; the fact of its existence in connection with them

"It is satisfactory to reflect that, whether these opinions are well founded or not, *we have abundant sources of gold in our quartz veins at a moderate depth,* and the quite recent alluviums and tertiaries are so rich, and occupy such great areas, that it is not probable the labours of the miner, except, perhaps, because of some accidental discovery of rich and easily-worked gravels of the mesozoic or miocene age, will be devoted to explorations in rocks, which at best, probably, will be expensive to work.

"In the early days of the gold-fields, quartz veins were neglected. The miners directed their attention alone to the alluviums, and when they discovered small particles of gold imbedded in quartz, they looked upon them with surprise. So little was known of the modes of occurrence of gold, that pieces of quartz, containing only small quantities of gold, and worth only a few shillings, were sold for £10 or £15. When, finally, they came upon a rich reef, cropping out at the surface, and saw large fragments of quartz richly studded with gold, they commenced to break it up. With the aid of a hammer they powdered the quartz, and obtained the gold either by washing or amalgamating with mercury. So rich was the matrix, that many of the miners in this manner earned from £6 to £10 per week. Gradually the cha-

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is not *forced* on the mind; and many persons, obliged to hold some belief, are unable to admit the possibility of its occurring at all, or in any form in these strata. They are incapable of judging of evidence, and do not seek for proof. This condition of mind has always operated as a most serious obstacle to the progress of science. The result is seldom so plainly shown as in the Colony of Victoria, and in America, where, but for apparently rash explorations, undertaken through ignorance, the geology of gold would not have been made known to the world.

racter of the reefs became apparent, more extended explorations were made, better appliances for crushing and grinding the quartz were obtained; and, at length, when experienced miners (acquainted with the use of stamps and the dressing of ores) came to the Colony, quartz mining began to engage the attention of a great number of persons. *Few believed, however, that it would continue to be profitable, and none guessed how important this interest would become.** At the present time† there are 17,730 miners engaged in quartz mining; and more than 2000 distinct reefs (lodes) have been discovered and named; and 522 steam-engines, equal to 9079-horse power, and 62 engines, driven by water or horse power, are employed in crushing, winding, pumping, &c. In place of small machines, driven by engines of ten or fifteen horse power, we have batteries of stamps and large establishments, the like of which, it is believed, cannot be found in any other gold-producing district in the world. Energy, and skill, and capital are now employed successfully in the extraction of gold from the matrix, and day after day very important additions are made to the engine-power on the gold-fields. At the same time, fresh discoveries tempt the quartz miner to abandon the old mines. At Wood's Point, Stringer's Creek, Donnelly's Creek, Crooked River, Tambo River, and numerous localities in and around Beechworth, valuable reefs are being prospected; and, if it were not for the great cost and difficulty of carriage, as large

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* Mr. Smyth is scarcely correct in this statement. The writer, and many others previously acquainted with the mines, expressed from the first their confidence in the permanent character of our quartz veins, and their continued productiveness.

† End of 1865.

establishments for reducing quartz would be erected at these places as at Clunes, or Ballarat, or Sandhurst.

"From estimates made very carefully, which, however, are not absolutely correct, it appears that the quantities of gold obtained from quartz veins were, during the four years undermentioned, as follows :—

	Oz.	dwts.
1863	493,499	0
1864	503,618	5
1865	450,000	0
1866	521,017	0

"In working a quartz vein, a shaft is sunk either on the crown of the hill, where the vein is found, or the reef is penetrated by an adit; and, as the dip of the reef is commonly at a high angle, lateral excavations are made from the shaft or adit, at various levels, from which the auriferous rock is excavated. The quartz brought to the surface is broken into pieces, and passed through inclining spouts to the stampers, which resemble the ordinary stamps used in other countries for dressing ores. They weigh about seven hundred weight each, and one stamp strikes about sixty blows per minute. A ten-horse power engine will give motion to eight stamps. The crushed quartz is carried by water (usually) over copper ripples, where the gold is brought into contact with mercury. Once a week, or oftener, the ripples are cleaned out, and the amalgam retorted.

"A great many inventions for the extraction of gold from quartz have been brought from time to time under the notice of the public. Where sulphides occur in considerable quantities a good deal of fine gold is lost, if care and skill are not employed, but a thoroughly-competent manager never fails to extract the greater part of the gold. It is not new inventions that are wanted so much as *ability and a faithful and honest use of known*

appliances; and this truth is illustrated at Clunes, where the difficulties are many, and the quartz by no means rich.

"'The following brief statement of the operations of the Port Philip and Colonial Gold Mining Company, who have a large and valuable property at Clunes, has been compiled by Mr. R. H. Bland, their resident director, and it will be read everywhere with interest by those who are engaged in quartz mining.

"'There are five reefs included in the workings, and the length of drives in each is as follows:—

	Feet.
Western Vein	4,460
Robinson's Vein	6,060
Old Man Vein	580
Eastern Vein	8,290
Welcome Vein	1,020
	20,410
Add Cross-cuts	5,180
Giving a total of	25,590

which is equal to $4\frac{7}{8}$ miles.

"'The depth of the main shaft is 464 feet;* but little quartz has, however, been taken out below the 374 feet level. The length of the claim, in the direction of the strike, is 440 yards, or a quarter of a mile. The thickness of the reefs varies very much, and may be stated as follows:—

	Feet.
Western Vein, about	9
Robinson's Vein, varying from 3 to ...	30
Old Man Vein	150
Eastern Vein, about	4
Welcome Vein, varying from 6 in. to	30

* This has since been sunk to a depth of 570 feet, and is still in good ground.

"'These veins are larger in depth, as well as more irregular in size.

"'The length of tramways on the surface, for the conveyance of quartz and mullock, amounts in the aggregate to about 2500 feet of single track. The engine-power used in hauling and pumping at the two shafts is about 85-horse power.

"'*Character of the veins.*—There are five principal veins, the middle one being for the most part hard, barren quartz, and on each side of this non-productive mass, there are two veins running nearly north and south, in the direction of the clearage of the slate. The westernmost veins underlie west, and those on the eastern side, east. The quartz occurs in these veins in large shoots, dipping north and south in opposite directions from the summit of the hill. These shoots of quartz are in some places thirty feet wide, while the continuation of the vein immediately above and below them is small. The quartz in three of the veins is of a more or less brown, compact character, and not generally hard; but, in the two middle veins, it is white, and more associated with raw pyrites, and of a harder nature. The pyrites occurs in veins and patches, and, when accompanied by galena, is generally rich. The gold mostly occurs in the lines of fracture in the quartz, but it is sometimes seen at the side of the quartz in the slate, and the most auriferous quartz dips north and south, with the shoots above alluded to. This is more particularly the case as the mine gets deeper.

"'*Cost of raising quartz.*—This may be set down at an average of about 13*s.* per ton, including cost of machinery and *dead work in the mine*, and delivery at the reduction works. The contracts for breaking out the quartz underground average from 4*s.* to 9*s.* per ton.

"'*Surface operations.*—The quartz, when brought to the surface, is separated into two lots. The small size is tipped into a large hopper, and, from thence, drawn and delivered direct to the stamps; and the larger lumps are sent to the stone-breaking machines, to be reduced to a size suitable for the stamps. Two of these machines are in constant use, working an average of about ten hours per day. Each machine will break about eight tons per hour when in good order, at a cost, including wear and tear, of about 10*d.* per ton. They are driven by a shaft, from one of the battery engines, and take about 12-horse power to drive the two.

"'The number of stamps at work is eighty, as follows:—*Fifty-six heads,* of about 6 cwt. each, including lifter and tongues, driven by one 24-inch engine, giving about seventy-five blows per minute, taking about 1-horse power per head, and crushing an average of about 2 tons 4 cwt. per head for twenty-four hours; *Twenty-four heads* of about 8 cwt. each, including lifter, &c., driven by a 24-inch engine, giving seventy-five blows per minute, taking, in the aggregate, about 30-horse power. These stamps crush about 4 tons per head per diem, and they have a larger proportion of the small material sent to them. The average quantity of quartz crushed per week of five days is about 1130 tons.

"'The following is a return of quartz crushed for the twelve months ending September, 1865:—

54,413 tons . 20,596 oz. 10 dwts. 12 grs. . 7 dwts. 13 grs.

"'The gold above mentioned was collected in the following way:—

Stamp beds	66·08 p. c.
Mercury boxes	22·95 p. c.
Blankets	10·97 p. c.

"'The quantity of water required to work the stamps

efficiently is about eight gallons per head per minute, which is 921,600 gallons per diem.

"'*Method of separating pyrites from the tailings.*—The *tailings,* on leaving the stamps, run into settling-boxes, where the current is checked and the heavier metal settles. These boxes are cleaned out every few hours, and the material sent to the *buddle,* where it undergoes a further concentration, and is dressed up to an average of 3 oz. or 4 oz. of gold to the ton of material. This is then sent to the roasting furnace, and afterwards ground in Chilian mills with mercury; and an average of about 85 per cent. of the assay contents of the gold is thus extracted. The cost of operating on the pyrites, including the *buddle,* roasting, and grinding, loss of mercury, &c., averages about £2 14s. per ton, or about £1 per ounce of gold obtained. The expense will diminish as the quantity of pyrites increases, and it improves in richness.

"'*Gold crystals.*—These are obtained from a mercury-box placed at the foot of the blanket strakes, which is placed there to catch stray particles of mercury, occasionally driven out of the upper boxes, as well as any fine gold that may have passed the blankets. These boxes are cleared out about once in four or six months, and it is found that the gold contained in them has become crystallized. The largest crystal we have noticed was the size of a pea. The crystals would no doubt increase in size, if left for a longer period.

"'*Quantity of quartz crushed.*—The quantity of quartz crushed, and yield of gold, from the commencement of the Company's operations in 1857, to the 31st of July, 1866, is as follows:—

Quartz crushed.		Yield of gold.
308,661 tons.	...	180,723 oz. 15 dwts. 10 grs.

equal to 6 tons, of 2000 lbs. each.'"

"The statement made by Mr. Bland should be perused and carefully considered by every one who is interested in quartz mines. It shows what can be accomplished by good management and the use of well-devised appliances, but even skill and knowledge, and the aid of good machinery, will fail to give satisfactory results, without honest and faithful supervision.

"The usual course pursued, when a rich vein is discovered by those who are in haste to make money, is to form a company, and to put machinery on the ground at a great cost, and to crush enough of the rich quartz to give notoriety to the mine. The original proprietors sell out when this is accomplished, and the property is left, in many cases, in the hands of men who are not well acquainted with mining. After a time, the reef is probably lost, the machinery comes to a standstill, and the adventure abandoned. The proper and honest course is to test the vein, to raise a great (sufficient!) quantity of quartz to ascertain the probable yield of gold from it (which is easily done, and with great accuracy by any one of experience), before incurring the expense of erecting crushing mills.

"Fortunately for the Colony, there are many able men engaged in the work of extracting gold from quartz;* they possess the requisite knowledge, and exhibit, too, very often, perseverance and energy which are truly surprising. Those who have seen their establishments in the centres of mining industry, and in the more remote parts of the Colony, must admit that we are not behind any gold-producing country in the world.

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* I am convinced that there is a great lack of really good mining managers.—R. L. M. K.

"*Many districts are, however, neglected. Very rich reefs have been opened in the neighbourhood of Beechworth, but little has been done to develop them. Capital, it is said, is wanting; but why capitalists should hesitate to engage in mining speculations in places where the stone yields on the average as much as* 1 *oz.* 7 *dwts. and* 1 *oz.* 3 *dwts. per ton, on quantities exceeding* 150,000 *tons, is inexplicable.*

"If any proofs are required of the value of our auriferous quartz veins, they are to be obtained from the records of the Mining Department. From returns made by the Mining Surveyors and Mining Registrars of the yield of gold from parcels of quartz, crushed during a period of seven years (from 1859 to 1865), it appears that 3,110,328 tons have yielded an average of 12 dwts. 6·375 grs. of gold per ton. These figures represent only the 'crushings,' respecting which the officers of the department have been able to obtain information, and do not show the quantities of quartz put through the mills; *but there is no reason to believe that the average yield would be less if all the millowners had furnished returns.*

"In the report of a commission appointed to inquire into the mining resources of the Colony of Victoria, which is without date, but appears to have been laid before Parliament some time during the year 1857, the miners were told that they must not expect to find gold in quantities to remunerate them beyond a certain depth, and this is fixed at forty or sixty feet; and capitalists were cautioned against the erection of permanent mining buildings on a gold quartz reef. Sir R. I. Murchison had predicted that rich veins would not be found at any but small depths below the surface, and to support this theory (which some practical geologists had contradicted)

a few cases of reefs, growing poorer as the depth increased, were cited.

"One instance to the contrary is sufficient to destroy the theory, but, perhaps, it may be more satisfactory to give many.

"A crushing of 865 tons from the claim of the *Sisters Company*, at Little Bendigo, near Ballarat, obtained at depths from 474 to 520 feet, yielded nearly half an ounce of gold to the ton.

"The *Victoria Company*, at Clunes, crushed 3365 tons; the greatest depth from which it was taken was 500 feet, and it averaged 6 dwts. 15 grs. per ton. A subsequent crushing, by the same company, of a lot of 3920 tons, taken from depths up to 570 feet, averaged 6 dwts. 20 grs. per ton.

"Thirty tons taken from a vein in the *Mariner's Reef*, Maryborough, which at the depth of 560 feet was ten inches thick, yielded 160 oz., being at the rate of 5 oz. 6 dwts. 16 grs. per ton.

"The *Sisters Company*, Little Bendigo, near Ballarat, crushed 200 tons, obtained at a depth of 567 feet, which yielded 96 oz. 18 dwts., being an average of upwards of 9½ dwts. to the ton.

"*At depths of from* 400 *to* 500 *feet.*—In the claim of the *Albion Company*, at Steiglitz, the stone obtained at 400 feet averaged 9½ oz. of gold to the ton. The manager, in his report, says:—'*The yield of gold has been steadily increasing with the depth of the vein*, and at the above depth the average yield is more than at any crushing since the formation of the company.'

"The *Victoria Company*, Clunes, crushed 2898 tons, from a depth of 406 feet, with a yield of nearly 6 dwts. per ton. Between this and 460 feet, 2814 tons yielded an average of 4 dwts. 11 grs. per ton.

"The *Sisters Company*, at Little Bendigo, near Ballarat, crushed 2763 tons, from depths varying from 429 to 470 feet, and the yield of gold was 6½ dwts. per ton of quartz crushed.

"*Campbell's Reef*, at Moyston, proved to be very rich at from 400 to 450 feet. Various companies crushed 4512 tons of stone, which yielded an average of 1 oz. 2 dwts. 16 grs. per ton. Two lots, of 224 tons and 402 tons, included in the above, yielded averages of 2 oz. 2½ dwts., and 1 oz. 12 dwts. 19 grs., respectively.

"The *Cross and Flat Reefs*, at Pleasant Creek, yielded stone at depths of from 400 to 460 feet, from which gold was obtained averaging 1 oz. per ton, from over 4000 tons crushed.

"A parcel of 482 tons, from a depth of 400 feet, at *Thornhill's Reef*, Maldon, averaged 15 dwts. per ton.

"The *Homeward Bound Company* obtained from the Rocky Point Reef, Stanley, 550 tons, yielding 18 dwts. per ton. It was raised from a depth of 400 feet.

"A crushing of 80 tons, from the same depth, on the *Rose, Thistle, and Shamrock* Reef, Buckland, averaged 3 oz. per ton.

At depths of from 300 *to* 400 *feet.*

"*At Thornhill's Reef*, Maldon, a lot of 146 tons of stone was obtained from a depth of 310 feet, which yielded 221·3 oz., or an average of about 1½ oz. per ton.

"*At Nuggetty Reef*, Maldon, from a depth of 300 feet, 1212 tons were obtained, which yielded 902 oz., or nearly an average of ¾ oz. per ton.

"*Johnson's Reef Company*, Eaglehawk, obtained, from a depth of 325 feet, 116 tons of stone, which yielded an average of 18 dwts. per ton.

"During the two latter quarters of 1864, the Port Philip Company, at Clunes, crushed a total 26,354 tons of stone, obtained from a depth of 300 feet to 374 feet,

and which yielded a total of 10,119½ oz., or an average of more than 7½ dwts. per ton.

"The *Hit or Miss Company*, Redcastle, obtained, from a depth of 300 feet, a lot of 35 tons of stone, which gave an average of nearly 5 oz. to the ton. Another lot of 56 tons was obtained from the same depth at *Clarke's Welcome Reef*, in the same locality, which yielded nearly 3 oz. to the ton.

"The *Albion Company*, Steiglitz, obtained, from a depth of 320 feet, 80 tons of stone, which yielded an average of 2⅕ oz. of gold.

"The *Homeward Bound Company*, Rocky Point, Stanley, produced, from a depth of 300 feet, a lot of 45 tons, which yielded an average of 3$\frac{1}{20}$ oz. per ton. The reef at this depth is 2 feet thick.

"Five hundred and sixty-seven tons, from a depth of 340 feet, were obtained by the *Band of Hope Company*, Little Bendigo, which yielded 422 oz., or nearly ¾ oz. per ton.

"A lot of 410 tons of stone, from a depth of 385 feet, was obtained from the old prospecting claim on *Poverty Reef*, Tarnagulla, which yielded, when crushed, over 1 oz. per ton.

"The *Moonlight Company*, Pleasant Creek, obtained 808 tons, from a depth of 360 feet, which yielded more than ½ oz. per ton.

"At the depth of 320 feet, 1510 tons of quartz were obtained from *Blucher's and Ironstone Reef*, Maryborough, which yielded an average of nearly ½ oz. per ton.

"The *Britannia Company*, Carngham, obtained an average yield of upwards of 5½ oz. to the ton, from 3198 tons of stone, taken from different depths, reaching to a maximum of 340 feet, It is reported that the quality of the stone *does not vary in any particular degree at the different levels.*

"The *Energetic Company*, Victoria Reef, Long Gully, Sandhurst, obtained, from a depth of 500 feet, 105 tons of stone, which yielded an average of more than 14½ oz. to the ton. Also the *Comet Company*, in the same locality, obtained 2039 tons, from a depth of 360 feet, which yielded upwards of 1¾ oz. per ton.

"The *Eaglehawk Union Company*, Maldon, obtained 1295 tons of quartz, from a depth of 300 feet, which yielded an average of upwards of 3⅓ oz. per ton.

"The *Alabama Company*, Caledonia Gully, Heathcote, obtained a lot of 374 tons of quartz, raised from a depth of 300 feet, which yielded an average of upwards of 1½ oz. per ton.

"The *Energetic Company*, Long Gully, had a crushing from the Victoria Reef of 1294 oz., from 55 tons of quartz. This stone was obtained from a depth of 305 feet. The reported crushing for the current year (first quarter) of the same Company gives an average of upwards of 14½ oz. to the ton of stone.

At depths from 200 *to* 300 *feet.* The *Bolivia Reef*, at Castlemaine, at 200 feet, averaged 1 oz. to the ton. One crushing of 140 tons averaged 5½ oz.

"*Tyson's Reef*, Sandhurst, has yielded a large amount of gold. One lot of stone, from a depth of 200 feet, yielding 1 oz. per ton.

"The *Reef*, named '*Poverty*,' at Tarnagulla, has proved to be one of the richest in the Colony. At 200 feet depth it yielded 600 oz. of gold weekly. At 300 feet, in Claim No. 5 North, the reef was 6 feet thick, and averaged from 6 to 7 oz. per ton.

"The *Sclavonian Reef*, at Redcastle, proved very rich, at a depth of 250 feet; four crushings, of 33, 32, 22 and 30 tons, yielding 11, 6½, 15½ and 12½ oz. per ton respectively.

The *New Chum and Cross Reefs*, at Pleasant Creek,

at depths of from 270 to 300 feet, averaged nearly 13 dwts. per ton.

"The *Britannia Reef*, Carngham, has yielded a large amount of gold. At a depth of 250 feet, the stone averaged about 7 dwts. per ton.

"Two lots from *Fentiman's* and *Perkins' Reefs*, Tarrangower, each of 6 tons, yielded respectively an average of 1 oz. 10 dwts. and 3 oz. per ton. It was obtained at a depth of 240 feet.

"Twenty-three tons from the *Catherine Reef*, Eaglehawk, yielded 341 oz. of gold, or nearly 15 oz. per ton.

"The *Yankee Company*, Clunes, in 1860, crushed about 120 tons weekly, obtained at a depth of 230 feet, which yielded at the rate of 1½ oz. per ton.

"The *Albert Reef*, at Whroo, was 2 feet thick, at 254 feet deep. The gold was uniformly diffused throughout the stone, and *averaged about* 12 *oz. to the ton.*

"The *Hicks' Reef*, Gordon's, at 210 feet, was about 18 inches thick. A crushing of 30 tons yielded 30 oz.

"During the first three quarters of 1864, the *Port Philip Company*, Clunes, crushed upwards of 30,000 tons, obtained at depths of from 230 to 300 feet, which averaged nearly 7 dwts. per ton. Since that date they have attained a depth of 370 feet, and the yield is stated under the head of quartz obtained from over 300 feet.

"The *Cornish United Company*, Ballarat, crushed 1000 tons, from a depth of 200 feet, average 4 dwts.

"Bow & Co. obtained, from a depth of 200 feet, out of the *Rose, Thistle, and Shamrock Claim*, a lot of 800 tons of stone, which yielded an average of over 1¼ oz. to the ton.

"Two separate lots of 3000 tons each have been obtained by two different companies on the *Oriental Reef*, which were raised from a depth of from 200 to 250 feet, and which yielded an average of 10 dwts. and 6 dwts., respectively, when crushed.

"The *Prince of Wales' Company,* Cobblers, obtained from a depth of 380 feet below the surface, but only a few feet below the level of the bed rock (the superincumbent rock being of volcanic origin), 2007 tons of stone, which averaged, when crushed, over 12 dwts. per ton. The reef, from which the stone was taken, at the above depth, was 12 feet thick. Subsequently it is reported as 17 feet thick, at a lower depth."*

The figures cited above are sufficient to convince even the most sceptical that theories formed on insufficient data are likely to be dangerous and injurious to science, as well as to retard the progress of a country. A man who has examined the gold-fields at Sandhurst, and who had known no other, would probably form theories which would prevent him from seeking for gold at Ballarat or Daylesford. And, in like manner, the geologist who has made a survey of the Ural, may not be in the best position to direct the miners of Victoria and New South Wales. We should receive his hints with respect, but his theories should not be blindly accepted, nor should we make the grave mistake of accepting, as laws governing the distribution of gold, those rules which are applicable only to limited areas. A person possessing local knowledge is a better guide in the *bush* than one who has gained a knowledge of the country from maps and books; and, in the same way, one who has worked in a deep *lead* and found gold, may be a better guide to the gold-seeker than the man who directs him to look for

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* The following is an extract from a letter received by me from Mr. T. Angove, manager of the Criterion G. M. Co., Clunes:—"The fact is beyond controversy, that we have at Clunes, the *Victoria* Mine, now 640 feet deep, producing richer stone than was raised 300 feet higher up. The stone at the present time yields over half an ounce to the ton, which leaves fully four pennyweights of gold per ton as clear profit."

it at a certain depth only, having based his opinion upon a theory, the data for which was as yet but imperfectly collected.

In order to show that in other countries the theory advanced by Sir R. I. Murchison and others has done harm, and that what has been termed a "scientific induction" has been prematurely arrived at, in fact, when quartz mining was only in its infancy, and when the gold miners' more recent discoveries were, consequently, not under the notice of the geologist, I would direct the attention of the reader to the following extract from *Dicker's Mining Record.* The paper was published originally in the *Alta California* :—

"The great quartz mines of the State are now attracting earnest attention, since long and persevering experiment has at last divulged, the true nature of the ledges (reefs), and the most effective mode of developing them. The quartz district, having a breadth of from fifteen to one hundred miles, commences in the south-east, or Mariposa, district runs north-westerly along the foot of the hills of the Sierra Nevada five hundred miles longitudinally through the centre of the State, until it passes into Oregon, and melts away on the Pacific shores. The ledge has generally an eastern dip, and at different angles, from nearly horizontal to perpendicular. The veins, of varying lengths, range from a few inches to some twenty feet, or more, thick. Throughout the ridge, holes have been punctured with more or less success, according to the skill, sagacity, perseverance, and capital of the operators. These have, indeed, *been misled by various theories of inexperienced science, as to the nature of the deposits, by ill-founded opinions as to the depths* to which the ore extends; and many shafts have been abandoned for many reasons. Numbers have, however, been very successful. But the great exemplar of quartz mining, not only for wealth or production, but as shedding more light upon the real nature and condition of quartz mining than most others, seems to be that of A. Hayward, Esq., at Suttar Creek, Amadar County. His mine is 1200 *feet perpendicular descent from the surface,* probably 300 feet below the ocean. It is, by all odds, the deepest gold mine in the world, and also the most productive. Yet the conditions of its yield

are such as to indicate that its powers are barely developed, *that it* settles the question of deep mining*, and that the wealth of gold contained in that mountainous ridge is far beyond the wildest dreams of the most sanguine Californian hitherto. Mr. Hayward, a lawyer by education, having had some experience in the lead mines of the Upper Mississippi, pushed across the plains early in the gold excitement, and reached California in 1850. After much exploration, his attention was fixed at Suttar Creek, Amadar County, in 1853. A mine had been commenced which satisfied the conditions that his sagacity and experience had laid down. He became interested in one-fifth, and went to work with that indomitable will and perseverance, which, like faith, moves mountains. The vein was but eight to ten dollars rock, but broad, and with difficulty was worked, at a time when flour was sixty dollars per barrel, wages in proportion, and living very high. With these high expenses, and poor rock, he struggled for years. In 1857 he was heavily in debt, but, having bought out all the partners, he had become sole proprietor. While he had carried on this desperate struggle, many around him dropped out of the race. They had been frozen out, and were forced to abandon their shafts, overwhelmed with debt. Mr. Hayward was not to be baulked. He had not spent a dollar uselessly, and he observed *that the ore improved as the shaft grew deeper*. The vein was broad, so that, in following it down, the shaft formed itself. Not a shovelful was taken out that was not reduced. The east wall of granite went down nearly perpendicular, and that was closely followed. At some hundred feet in depth, the ore paid from twelve to fifteen dollars. The expenses being kept within the closest limits, this began to pay, and each succeeding year it has given greater results, until, at the depth of 1200 feet, the ore averages twenty-five dollars, with a breadth of twenty-two feet, and widening as it leaves the shaft, in both directions, north and south. At this depth, the present writer picked out samples of ore from masses of, probably, fifty dollars rock. The smooth granite wall rises nearly perpendicular, 1200 feet to the surface, and the timbering is done between the walls. The logs are hauled some six miles, at a cost of six dollars each. The gallery runs north and south along this wall. The 1000 feet level is some 5000 feet in length, communicating with three shafts, giving perfect ventilation; from this the ore has been mostly removed. The lower level is some forty feet long, and at either end is the beautiful quartz, with its blue and white vertical ribbons, glit-

* The italics are mine.—R.L.M.K.

tering with the metals. At this depth, the value of the ore at the north end improves faster than that of the south end—rather reversing the process above.* Some of the ore here is forty-five to fifty dollars, and some ranges probably to nearly a hundred. The ore above in the galleries, and that here in sight, is equal to three years' run, say, 2,000,000 dollars. Into this depth drop iron buckets, suspended by strong ropes, of continuous length, manufactured by San Francisco works. These ropes, passing over swifters at the top, wind over drums, worked by a hundred-horse engine of the most approved pattern for service. This operates night and day. Three sets of hands relieve each other every eight hours below, and sixty tons per day are sent to the surface, dumped into a rail car, which descends by its own weight to the mill, a short distance on Suttar Creek, so named from the fact that Suttar once mined there. The mill runs forty stamps, of 450 lbs. each, at a speed of some eighty strokes per minute. The rapid trituration of ore and sulphides is found much more effective than the slower strokes of heavier stamps. The mill is driven by water in the wet season. This is brought by a flume from a very substantial dam above. A powerful engine is also at hand; and at this season, when water runs low, it assists the water-wheel, gradually increasing in power, until, later, the water is taken off altogether, and reserved for washing. The 'clean up' every fourteen days varies slightly in results, *the tendency being always to increase.* The ore is not selected, but always that is taken which most facilitates the operations of the miners. No day's work is thrown away, and no stroke of the pick made that does not tend directly to the main point of getting ore. This is the secret of success. From this mine, which has been worked for the last thirteen years by Mr. Hayward, himself a most experienced and skilful operator in every branch of the business—assisted by three able men (Messrs. Hazlehurst, Morgan, and Hunter); there has been extracted, probably, six to seven millions of dollars. This is a great fact; but, what is more important to the public, a still greater fact presents itself, viz., *that quartz veins increase in width and value in proportion to depth.* The mine in question shows a true fissure—an injection of gold-bearing quartz from below, and which tapers off in size and value as it approaches the surface. Following it down a distance of 1200 feet has demonstrated this fact. There are no other mines that approach this in depth. The Eureka Mine, in Grass Valley, is 300 feet down, but is of richer rock than was the Suttar Creek Mine at that depth. The ore is of the same appear-

* I imagine the *shoot* of gold dips *north*.—R.L.M.K.

ance in both. Considering all these circumstances, the public will have to look forward to a gold production in this State of a magnitude compared to which all that has gone before is nothing. It is to be borne in mind that miners now have not to encounter the fearful trials that beset Mr. Hayward's early struggles. The cost of living is barely one-fourth; wages are less than one-half; transportation is greatly reduced; steam and rail now bring both Suttar Creek and Grass Valley, 190 miles each from San Francisco, within twenty hours' journey, without breaking a night's rest; and, lastly, money, instead of being 10 per cent. per month, is 10 per cent. per annum. Capital is now so abundant, and so understandingly employed, that no man who has a good mine need want capital to work it. The facilities of travel into Neveda and Amadar countries will soon embrace every important section, and tap every reservoir of wealth."

I have endeavoured, in the foregoing, to produce evidence of a character not to be disputed, that immense areas of auriferous country exist in Victoria, and that these areas are practically inexhaustible.

I will now proceed to point out the facilities that exist for the safe investment of capital on those gold-fields.

It would naturally be asked by persons at a distance, who were solicited to enter into a speculation far from their homes, "Why, if there are such facilities for the investment of capital, do not the local capitalists take advantage of it?" To give a satisfactory answer to this question may appear, at first sight, to be difficult, but nothing is more easily done. When it is known that of the 30,348 square miles of country, "in any part of which," to quote Mr. Selwyn, "there is a possibility of remunerative gold deposits being found, either in veins or alluvial deposits," and that of this, the actual area mined upon is only $869\frac{17}{40}$ * square miles, within which comparative small area over 2000 † quartz lodes have

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* Statistics, 1866.

† Many of these lodes, or reefs, having separate names, are in reality one and the same. I think the 2000 may be safely divided by 3.—R.L.M.K.

been opened and named, and that within even this small space there is room for the remunerative employment of *four times* the number now actually engaged in mining, it must naturally force itself on one's mind, that mining must be of such a remunerative character, that few persons would engage their capital in any other channels.

Mining, however, has its blanks as well as its prizes, and there are many more blanks in Victoria (in a speculative sense) than there should be. Of the numberless companies organised, fully three-fourths of the unsuccessful ones have failed through sheer mismanagement.

It is only very lately that quartz mining has begun to be understood, and such rapid progress has been made in this branch of mining, that in a few years this interest will be of vast importance.

Of the reefs already discovered, the evidence goes to show, that if the gold does not *increase* in depth, it does not *decrease;* the illustrations in former pages give ample testimony on this head.

It is quite probable that the average yield was higher from the quartz first treated; this was, however, because the stone, which will *now* give a dividend of 200 per cent. per annum on the subscribed capital, would not, in the early days of gold mining, yield sufficient to pay working expenses, the cost of crushing, &c. Quartz is being treated at the crushing machines now for as many shillings per ton as at one time it cost pounds: and labour is almost proportionately cheap.

Now that quartz mining is reduced almost to a science, the experienced mining engineer *could not fail* in producing good results from the investment of capital. Heretofore, companies were started, sometimes by unprincipled men, who cared not for the ultimate results

to the shareholders, so that they might immediately serve their own purposes; at others, by men honest enough, perhaps, but not possessing the requisite knowledge of the science of mining to ensure success. In fact, many failures arise from, in the first instance, a wrong selection of ground; in the second place, the subscription of insufficient capital to carry on the work when commenced; in the third place, from the unscientific manner in which the actual operations are carried out. Another rock, on which mining companies split, is the influence brought to bear on the stock by scheming shareholders, who raise false and inordinate hopes by the circulation of garbled reports as to the real state of the property. A hundred circumstances, all of which may be avoided, have arisen to give the Victorian mines an unenviable notoriety.

A stranger examining the share list of the Victoria Stock Exchange, would have a very bad impression of the results of mining in Victoria. For instance, the total (nominal) capital of *the registered companies* in Victoria at the end of 1866, as per Government returns, was as follows :—

	Companies.	Capital.
Ballarat	691	£7,904,986
Beechworth	561	5,239,925
Sandhurst	171	2,927,838
Castlemaine ...	390	1,953,306
Maryborough ...	125	1,194,080
Ararat	44	257,776
Total ...	1,982	£19,477,911

Although the *nominal* capital of the mining companies registered in Victoria amounts to nearly £20,000,000, I question if *one-tenth* of that amount has been subscribed.

In illustration of my opinion, I give below the result of some inquiries on the subject; and, as my intention has been to treat more particularly on quartz mining, I made minute inquiries in the Sandhurst district (the, at present, great quartz district of the colony). The Hustlers and Catherine Companies being of some importance, I requested the managers to reply to certain questions which I gave them. The result I give below.

"Catherine Reef United Claimholders'
"Gold Mining Company (Limited).

"1st. *The date of the formation of the above Company?*—5th March, 1861.

"2nd. *Number of tons crushed?*—To April 13th, 1867, 98,658.

"3rd. *Yield of gold therefrom?*—33,167 oz. 12 dwts.

"4th. *Amount of dividends paid?*—On original capital (£62,600), £31,300, being 10*s.* per share.

"5th. *Amount of subscribed capital spent?*—The subscribed capital of the company, at its formation, was £62,600, in £1 shares, fully paid up, and 5000 reserved shares. The company was formed by the amalgamation of a number of small claims, on the basis of £100 per yard *on the line of reef.* Most of the claimholders were paid in shares as above, but some were paid in cash, and some partly in cash, and partly in shares. There was paid for the ground in this manner £50,884; for the machinery and plant then on the ground, £8500; thus *leaving a balance of* £3216 *for the expense of forming the company, and for a working cash capital.* The whole of the cost of sinking the main shaft, opening up the ground, erection of machinery, and construction of permanent works has (less the balance as above) been defrayed out of the gold obtained since. The amount expended on this account I estimate at about £30,000.

In November, 1865, the company purchased other 220 yards of ground on the same line of reef, paying for it 3000 of the reserve shares, thus making the present capital £65,600.

"6th. *Depth of workings?*—Main shaft, 426 feet, and still sinking. Gold in all the spurs cut recently. Lowest level at present, 292 feet. Another level will be opened out at 420 feet, after sinking another 10 feet.

"7th. *Present value of mine and plant?*—Taking the present value of shares at 5s., as per Stock Exchange list, £16,400.

"8th. *The lowest yield that will pay working expenses, with a given sized reef at given depths?*—For the six months, ending February 28th, 1867, the average cost of raising and crushing, including all charges in the mine, was 13s. 3d. per ton, and for the six months previously, 12s. 11d. per ton, or 13s. 1d. for the last twelve months; but, owing to the number of stoppages on account of the scarcity of water, the last year was an unfavourable one. With a lode averaging six feet wide, to a depth of 300 or 400 feet, I should say 3 dwts. to the ton would pay working expenses in this mine. In the estimate of cost of raising and crushing, and also in the estimate of 3 dwts. per ton, I have not taken the interest on nominal capital, or general depreciation of plant, into consideration.

(Signed) "THOMAS EYRE,

"April 17th, 1867." "Manager.

"Bank of Victoria, Eaglehawk,

"Sandhurst, 17th April, 1867.

"R. L. M. Kitto, Esq., Melbourne,

"Dear Sir,—Enclosed I hand you report from Mr. Thomas Eyre, manager of the Catherine Reef United Co. here, on the points you requested information. You can

rely on the correctness of whatever is stated in the report, and I trust it may be of service to you.

"I am, very truly yours,

(Signed) "R. W. ANDREWS,

"Agent, Bank of Victoria."

The following information is from the manager of the

"Hustlers Reef Quartz Mining and Drainage Co.,

"Sandhurst, 4th April, 1867.

"This Company was formed in September, 1860, in 20,870 shares, *on which 5s. 6d. per share has been called up, and 16s. 6d. per share has been paid in dividends.*

"I estimate the value of the mine and plant at one pound per share.

"I am at present working two reefs. The surface reef varies from 5 to 23 feet wide, and the deep reef averages about one foot in thickness. What I call the surface reef is from 130 feet upwards. The deep reef is working at 410 feet from the surface. The surface reef is payable at 3 dwts. per ton.

(Signed) "JOSEPH MILLIN,

"Manager."

"I certify to the genuineness of this document, and most of the facts stated are well known to me.

(Signed) "S. A. SUTHERLAND,

"Accountant, Bank of Victoria, Sandhurst."

The Hustlers Reef Co. appears in the Melbourne and General Share Circular as a company having 20,876 shares of £1 6s. each, of which amount £1 5s. 6d. appears as having been "paid up." The real state of matters is, that the original proprietors, viz., those who took up the ground, valued their interest at £20,876; they required assistance to erect machinery, and established a company, consisting of 20,876 shares of £1 6s. each, £1 paid up,

leaving really only 6s. per share to carry on mining operations, of which amount 5s. 6d. has been called up. The company is, however, a successful one. 16s. 6d. per share (300 *per cent. on the actual capital called up*) has been paid in dividends, besides a large battery of stamps, pumping gear, &c., costing some thousands of pounds, having been erected, out of the proceeds of the mine.

These are only specimens, illustrating the modes and methods by which a large total of "stock" is created. Even with such inflation as this, after a year or two, most of the mines will give—and many are giving—from 20 to 200 per cent. per annum on the (nominal) capital.

Nothing that I could advance would give a better illustration of the elasticity of our mines than the facts I have adduced.

In a country like Victoria, possessing agricultural lands second to none in the world, vast areas of pastoral land, where flocks and herds are easily raised, and where capital increases while the "investor is asleep"; in a country where the vine flourishes to perfection, and fruit trees grow as perhaps in no other part of the world; where, on the tops of the vine-clad slopes, the golden ores are distributed over an area, bounded only by the extent of the Colony. In a country larger than Great Britain, possessing such resources, owned by a population of only some 600,000 souls, need one wonder that the *best* only of this wealth is culled, that only here and there are portions of the golden treasures exhumed? Will any one be astonished that the miner, although working a golden claim, abandons it because it may not yield to his satisfaction, in order that he may search among the many thousands of reefs that abound, for one *more* golden?

And there are hundreds of such golden quartz veins so abandoned in Victoria. Ten thousand more untouched.

What a field, then, is there for the judicious outlay of

some of the unused wealth of Europe, and for the employment of many thousands of her straightened mining population. If half were only known of the mines of Victoria, there would be no hesitation on the part of monied men to join heartily in the development of these vast areas, both to accumulate wealth to themselves, and assist some of their fellow creatures to raise their heads above the penury of their present homes.

To illustrate, as far as possible, the mismanagement of some of our mines in its various phases, I will give the results of my own experience.

In the year 1859, there was a general mania amongst the public to invest in mines; hundreds of companies were formed, of which number many died an ignominious death before even the mine was touched. Amongst those having more than ordinary chances of success, was the *Wattle Gully Gold Mining Co.*, in the vicinity of Castlemaine, started by myself, and of whose mine I was appointed manager. The nominal capital was £25,000, and I was informed by the directory that, after paying for the "claims" purchased from those in possession of part of the area, there would be £20,000 available as a working capital.

It must be remembered that the mine was discovered, known to be rich, and that the position of the various workings, as well as the machinery, had only to be decided on, in order to bring the mine into full working order; so that the time when it would become self-supporting could be approximately fixed.

I set to work, and laid out the position of my shafts, pumping and winding engine, and crushing machine (stampers), with the belief that the capital at my command amounted to the sum named. At the end of three months, I had a fine engine shaft sunk from the surface to a depth of 120 feet, pumps fixed, and pumping engine

at work, and three *whim* shafts, on various portions of the mine, at depths varying from 60 to 150 feet, whims erected, offices of various kinds completed, &c. At the end of four months, at the 60 feet (10 fathom) level, I was prepared to send sufficient remunerative quartz to the stampers, which by this time were in working order.

Owing to there having been so many *bubbles* started about the same time as the *Wattle Gully Company*, a general crash ensued; and, notwithstanding my entreaties, the directors of the *Wattle Gully Company* refused to make further calls, (they being the principal shareholders), and as the result of the work of some ten miners in obtaining quartz, was not sufficient to meet the cost of an establishment for some 85 men, and two steam-engines, the property was sold for a mere song, after some £6000 had been spent in making preparations to carry the adventure to a successful issue.

I cannot help looking at this mine as it exists at present (divided amongst some ten or twelve parties of miners) with feelings of both pride and regret; pride, that my conclusions were correct, and regret, that persons should enter into mining speculations, who are rather guided by the fluctuations of the mining share market than the intrinsic value of the property in which they hold an interest. Many miners have made small fortunes from the *Wattle Gully* property since it was abandoned by the company, and at the time I left Victoria, in April this year, that mine was yielding, in the aggregate, nearly 400 ounces of gold weekly.

The above is an illustration of the folly of many of the shareholders in mining companies. Unfortunately, however, this is only *one* phase of the mismanagement to which the Victoria mines (quartz especially) are subjected. I give below an extract from *Dicker's Mining Record* of 19th March, 1867, in order to show how money

is often needlessly spent by the officers of these companies through sheer ignorance of their business.

"MINING MANAGEMENT AT BALLARAT."

"As an instance of how things occasionally are managed at Ballarat, we extract a few facts from the report of the *Charlton Company*, which appeared in our issue of December 11th, supplemented by a report of the proceedings at an adjourned special meeting on Tuesday last. Be it remembered that close on £4000 has been called up. The report of December says—a shareholder wanted to know *why one of the drives, after travelling about to all points of the compass, a distance of* 300 *feet, passed at last within* 10 *feet of the shaft?* Mr. Robertson (one of the directors) said, the drive *was a mistake*,* arising from the want of a compass to guide the mining manager; and, on being asked why a compass was not provided, replied that the company could not afford one. (Confusion and dissatisfaction), several voices. 'Could not afford £2 for a compass, and £4 per week had been voted for a weekly visit of one of the directors to the claim.'"

Although, with few exceptions (the Port Philip, at Clunes, for instance, and those under the legal management of Mr. Schlesinger), the quartz mines of Victoria are not well managed, yet the result of mining for gold in quartz reefs is, in the aggregate, infinitely better than from the alluvial workings. I find, from the Government statistics, that, during the year 1866, 55,916 persons were engaged in alluvial mining, and 14,878 in quartz mining. The result is, that the earnings of the *alluvial* miners average £66 4s. 1d. for the year, and those of the *quartz* miners £132 17s. 4¾d., for the same period.

It must not be forgotten that 20,100 of the number of *alluvial* miners are Chinese, who are content to work for a few shillings weekly. This very abstemious, but industrious, race may be very properly called the scavengers of the gold-fields; they rework the shallow alluviums after they are abandoned by the European miner, and, also, in many instances obtain a living by sweeping the roads

* I should think it was.—R.L.M.K.

which have been macadamized with quartz metal, in order to obtain thereby the stray particles of gold that may have been in the stone, and afterwards separated by the crushing of the heavy traffic.

I am sorry to state that amongst the European alluvial miners are numbers, who, mostly lost to all sense of good, are content to eke out a miserable existence from the shallow alluviums, rather than contend with the harder work of quartz mining. In a few years, however, individual mining, as it is called, will be no more known; the quartz mines and deep *leads* will become the property of the capitalist, and will be worked with science and skill; the workman will be better and more regularly paid, and once more the social system will be properly regulated.

When it is considered that of the 14,878 quartz miners who were at work in the Colony during 1866, fully one-third were either *prospecting* or expending their labour uselessly, it cannot fail to strike the most obtuse observer that the result of quartz mining in Victoria is exceedingly good.

I am certain that quartz miners engaged in working reefs, *known* to contain gold, realise over £200 per man per annum. The wages of the hired miner range from £1 15*s*. 0*d*. to £2 5*s*. 0*d*. per week, or an average of £2, thus giving exactly one-half of his labour to meet expenses of wear and tear of machinery, and the payment of dividends. The proportion in favour of the capitalist will be increased to a large extent when the mines are systematically worked.

There are so many outlets in Victoria for the investment of capital, that the mines can of necessity receive only a small proportion. There are large areas of the partially worked gold-fields unoccupied—larger than those

occupied—and it is impossible that they can be worked without the aid of capital.

The public companies only, (those registered under the Mining Companies Limited Liability Act), have a nominal capital of £19,477,911, of which sum about one-tenth is paid up. The proprietors of the mines pay the banks 10 per cent. and 12½ per cent. for what little money they can obtain from such sources. The liabilities of the registered companies at the end of the year 1866 amounted to £469,395 17*s.* 7*d.*, of which sum only £208,326 10*s.* 9*d.* was obtained from the banks, thus leaving a balance of £261,069 6*s.* 10*d.* due to other creditors, for a great portion of which 15 per cent. or even 20 per cent. is often paid. The banks have so many outlets for their money, that they have not the means to advance on mines to a larger extent. The consequence of this want of money is, that instead of mining operations being carried out as they should be, the companies live, to use a homely phrase, "from hand to mouth." If, however, money were cheap, say 10 per cent., there is ample room for the immediate and safe absorption of a large amount of capital.

Mining properties may be secured at once in Victoria, either by purchase of existing leases, or taking possession of crown lands not at present occupied.

The *regulations relating to Gold Mining Leases* are very clear. First: Provision is made for the application in proper form. After the survey has been made, the lease is granted, if there be no sufficient objections to its issue. Clause 30 provides for the registration of leases. Clauses 20 and 21 provide for a *power of attorney*, to be given to an agent, if the lessee should be unable to execute he lease in person.

Of the 30,348 square miles, "in any part of which here is a possibility of remunerative gold deposits being

found," only 869$\frac{17}{40}$ square miles, or about $\frac{1}{3^3}$ have been mined upon; and of the area mined upon, only about one-sixth ($\frac{1}{6}$) (or about $\frac{1}{200}$th of the whole auriferous country) was occupied at the end of 1866. The exact area held by the miners was 76,546A. 1R. 26P. as "claims" under the mining bye-laws; and 19,923A. 2R. 8P., under lease from the crown.

The present market value of the "claims" on the gold-fields is £8,987,067 sterling, and the machinery is estimated at £2,068,527 sterling, making a total value of the mines and machinery at the present hour of £11,055,594. The yield of gold for 1866 was worth £5,916,779, of which amount £4,077,197 18s. 4d. was the produce of the alluvial gold, and £1,839,581 1s. 8d. from quartz.

My intimate acquaintance with the gold-fields, having been engaged for eleven years in connection therewith, as miner, manager of mines, and during the last seven years as Government Mining Surveyor, enables me to state, without fear of contradiction, that I am *within* the estimate, when I say that of the 869$\frac{17}{40}$ square miles which have been partially worked, and of which only one-sixth is at present occupied; fully two-sixths, or *twice* the area at present in the occupation of miners, is quite as valuable for gold as that now held.

On the quartz lodes, for instance, only such portions as are near the "outcrop" (where the auriferous stone was discovered on the surface) are occupied. These reefs can be traced many miles, and, as the *shoots* of golden stone run pretty regular, it only requires capital to open mines of wealth, equal to any yet opened. Again, many lodes have been abandoned, because of some break in the reef, and the inexperienced miner has left it, thinking he has found the bottom. Further, many of the mines at present being worked may be

purchased very cheap, from the fact of the owners being unable to follow the reef below the water-level. Some of these claims are held for years by men who are barely making a livelihood, but are unwilling to abandon that which they know to be good; and, like Micawber, are "waiting for something to turn up." Many poor fellows have so waited, until, broken both in pocket and heart, they are forced to abandon that from which they anticipated a fortune, and from which great riches have been made.

Without going beyond the area *proved to be auriferous*, there is room, as I said before, for the investment of millions to advantage. At over £11,000,000 is the mining property of the Colony now estimated. There is room on the *known gold-fields* to create additional mining property to the extent of twice eleven millions. I speak advisedly, and am prepared to prove the soundness of my deductions, by documentary and other evidence, before any committee of scientific men that may be desirous of inquiring further into the gold resources of Victoria.

Should the information I have given in the foregoing pages be the means of creating a desire on the part of the capitalists of Europe to invest in the Gold Mines of Victoria, I would advise them to confine their operations, for the present at least, to those portions of the country which have already been proved to be auriferous. I am borne out in this opinion by the highest authorities in the Colony. The following letter, received by me from Mr. C. D'O. H. Aplin, late acting director of the Geological Survey of Victoria, speaks for itself:—

"70, Temple Court, Melbourne,
"16th April, 1867.

"R. L. M. Kitto, Esq.

"Dear Sir,—In reply to a question you asked me in conversation a few days ago, regarding the extent of

unoccupied auriferous lands in this Colony, I cannot, I think, do better than refer you to the 'Geological Sketch Map of Victoria,'* on which the portion, coloured light purple, or slate colour, represents the approximate area occupied by Silurian rocks, amongst which alone our auriferous quartz reefs are found. The small patches of dark purple show the portions already worked and in occupation by our mining population.

"The relative proportions of these two colours will sufficiently indicate the scope that yet remains for the development of mining enterprise; and the security of tenure, at a moderate rental, provided by our Legislature, was expressly designed to afford the utmost encouragement for the introduction and employment of capital on our gold-fields.

"With regard to this subject, however, I am of opinion that, at present, and for some time to come, capital can be more advantageously employed in our *known gold-fields* than in attempting to make new discoveries by prospecting in unworked or unoccupied districts.

"I am, dear sir, yours faithfully,

"C. D'OYLEY H. APLIN,

"Late of the Geological Survey of Victoria."

Were I so disposed, I could cite hundreds of instances —nay, thousands—of miners making a rapid fortune, through the discovery of a very rich *lead* of gold, or a quartz reef of extraordinary value.† It is not my

* To be seen at the School of Mines, Jermyn Street, London, or at the Port Philip Gold Company's Office, 35, Bucklersbury.—R.L.M.K.

† In nine cases out of ten, these *very rich yields* are not included in the Government returns. I know a firm of quartz miners who have netted over £50,000 to each partner within the last three years, and they absolutely refuse to furnish the Government with returns of gold obtained from their mine.

intention, however, to refer to these; common sense tells us that those fortunate enough to make such rich discoveries require no aid, and are not desirous of admitting the outside public into a partnership that would be so profitable.

I shall proceed *to show how small a yield* will remunerate the miner, and then estimate the result of mining for gold in the quartz veins of Victoria on a large scale.

Instances are known, where the quartz is in large quantities and easily obtained, and where the machinery is extensive, and of the best description, where a yield of 2½ dwts., or 10s. worth of gold per ton of quartz, gives 33 per cent. per *annum* dividend, as in the *Black Hill Co.*, Ballarat. Everything, however, in this case, tends to assist in the result. The hill of quartz—for it is nothing less—is so situated that the machinery is fixed hundreds of feet at the foot of it, and all the stone *falls* into the passes—a very different thing from sinking expensive shafts, making drives, and using the pumping and winding appliances necessary.

The *average* yield of gold from the quartz crushed in the Colony as per Government returns, is 11 dwts. 22·8 grs. to the ton of stone: the average for last year was 10 dwts. 16·2 grs. to the ton of quartz.

The cost of raising and crushing quartz, together with cost of management, from an average sized reef, say, four to five feet thick, will be about 13*s.* per ton, at 300 to 400 feet from the surface (I give the outside estimate).*

Taking the above estimate as a basis, I find that, with the average yield of the Colony, viz., 10 dwts. 16·2 grs., or about 43*s.* per ton, the actual profit of working quartz mines would be 30*s.* on every ton of quartz crushed.

I will, however, to be on the safe side, presume that a

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* See the letter of Mr. Eyre, Manager of the Catherine Reef Co.

company, established for the purpose of carrying on extensive mining operations in various parts of the Colony, were so unfortunate as to obtain only 7 dwts., or 28*s.* per ton on the average, about $\frac{7}{11}$ths of the average of the Colony, as also that their operations were carried on, on the scale, say of £25,000 spent on each establishment.

The result would be as follows :—

Cost of opening and management of mine, say - - - - - - - - - -	£9,000
Machinery and plant, of various kinds -	11,000
Contingencies - - - - - - - - - -	2,000
Reserve Fund - - - - - - - - - -	3,000
	£25,000

A plant, such as the above amount would purchase, would reduce at least 600 tons of stone weekly, at an expenditure of 600 × 13*s.* = £390 weekly, and the yield would be 600 × 28*s.* = £840 worth of gold, weekly, thus giving a weekly profit of £450, or £23,400 per annum.

Allowing £10,900 for contingencies, such as loss of time through accidents to machinery, &c., a clear profit of £12,500, or 50 per cent. per annum, would accrue to the shareholders.

A great authority has stated that "anything may be shown by figures," but I ask the reader carefully to refer to the statistics I have produced, and satisfy himself as to the soundness of my calculations.

As a fair specimen of what may be done with an average yield of gold per ton of stone, under great difficulties, I give below a copy of the report of a meeting of the *Comet Company (Registered), Redan Hill, Bendigo.*

Through mismanagement, this mine was very nearly closed. The shares were absolutely unsaleable, when Mr. R. Schlesinger undertook the *legal* management,

and, by employing experienced men to carry on the works, has brought the mine to its present condition.

In two years, from February, 1865, to February, 1867, £27,600 have been paid in dividends (over 39 per cent. per annum), and the stock, which was worthless, is now, in the depressed state of the market, worth £21,000. The report is copied from *Dicker's Mining Record.*

"The general meeting of this (the Comet) Company was held at the offices, 37, Market Street, Melbourne, on Thursday last, the 10th January, when there were present Messrs. H. T. Dana, W. B. Jones, J. J. Selfe, J. G. Daffet, R. Schlesinger, W. Hick, J. Orniono, J. Webster, J. Dodgshum, B. Hick, T. G. Goold, R. P. Curtis, T. Landsell, and other shareholders. The half-yearly report of the board of management was presented to the shareholders, as follows:—

"1. In submitting a report of the operations for the half-year ending 31st December, your Board have the pleasure of stating that, although the results realised during that period bear an unfavourable comparison with those of the preceding half-year, yet, taking into account the extensive nature of the prospective operations, and the large amount expended in permanent works, the half-year's returns have been of a very satisfactory character. Besides the amount of £185 18s. 11d. expended in connection with the new boiler, and improvement to the machinery, the north drive, at the 390 feet level, has been continued 65 feet, and the south drive, at the same level, 60 feet. The drive between the 270 and 390 feet levels, known as the middle drive, has been continued north 178 feet, and south 40 feet. The drive at the 270 feet level has been extended north 33 feet, and the cross-cut, at 170 feet from the surface, has been driven west 107 feet. The fixing of a new plunger lift has, also, involved a cost of £200. Contracts have been accepted for sinking the engine shaft a further depth of 50 feet, at £4 5s. per foot, and 14 feet of this work have been completed.

"2. During the half-year ending 31st December, 5422 tons have been passed through the stampers, consisting of 1359 tons of public crushing, for which £348 5s 6d. has been received, and 4063 tons from the Company's ground, principally obtained from the Hustlers Reef, yielding 2190 oz. 18 dwts. 18 grs. gold, or an average of 10 dwts. 18¾ grs. to the ton, realising £8702 0s. 3d. The following statement exhibits each month's returns. The total amount received

from gold since the commencement of the Company's operations in 1861, is £63,263 8s. 8d.:—

	Tons.		Oz.	dwt.	grs.					
July	704	yielding	477	0	0	gold,	realizing	£1915	1	6
August.....	694	„	324	0	12	„	„	1283	2	0
September..	672	„	257	18	12	„	„	1024	8	6
October ...	692	„	246	18	12	„	„	969	10	9
November..	755	„	397	6	6	„	„	1577	6	6
December..	566	„	487	15	0	„	„	1932	11	0
	4063		2190	18	8			£8702	0	3

"3. Your Board beg to submit balance-sheet and accounts duly audited, showing that the receipts amounted to £9091 4s. 9d., consisting of £8702 0s. 3d. received from gold, £348 5s. 6d. from public crushing, and £40 19s. from drainage and transfer fees. The expenditure, chargeable to profit and loss account, amounted to £5334 19s. 3d., including £1591 6s. paid on account of wages, £2089 6s. 8d. paid on account of contracts, and £504 10s. 9d. for firewood. The profit on the half-year's transactions amounts to £3756 5s. 9d., equal to 21¾ per cent. per annum on the paid-up capital, making, with £3037 19s. 1d., from previous six months, the balance at credit of profit and loss £6794 4s. 10d., of which £3200, or 2s. per share, has been distributed amongst the shareholders. Your Board beg to recommend a further dividend of 9d. per share, payable on and after the 11th inst., making the total amount paid in dividends since the Company's operations commenced £27600, or 17s. 3d. per share, of which £26,800, or 16s. 9d. per share, has been paid since October, 1865.

"4. The shareholdors are now called upon to elect four directors and two auditors for the ensuing six months.

"Signed, on behalf of the Board of Management,

"RICHARD S. DAWSON, Chairman."

Any practical man, reading the above, will see clearly that a very large expenditure has arisen from the carrying out of purely opening work. The yield of 10 dwts. 18¾ grains to the ton, will give fully 100 *per cent. per annum* on the capital of the company, when *stopeing* (blocking out) commences.

MANAGEMENT OF THE GOLD-FIELDS.

The Mining Statute 1865 (Act 29 Victoria, No. 291), came into operation on the 1st January, 1866.

The enactment enters into all subjects connected with mining, almost to the most minute detail. Under its provisions, a document is issued, termed a "Miner's Right," which is in force for one year, and it empowers the holder thereof to mine for gold on crown lands, on the payment of 5*s*. Under the former Act this charge was £1. This document can be taken out for any number of years, not exceeding fifteen. There is also power for a company to take out a Consolidated Miner's Right for all ground held by them under the Mining Board Bye-laws. A holder of a Miner's Right may take up a quarter of an acre of land for residence purposes, which he is at liberty to assign to any other holder of a Miner's Right; and the "right" itself may be assigned. The extent of ground that may be held for mining purposes is determined by the local mining boards, and it varies in different districts.

Persons requiring to carry on business upon the gold-fields are permitted to occupy an area, not exceeding a quarter of an acre of crown lands, upon payment of £5 per annum. This license may be transferred to another person, who can, upon payment of a fee of 10*s*., and the surrender of the original license, obtain a new one for the unexpired term. The value of all buildings held under Miner's Rights, or business licenses, is allowed to the owners, in the event of the land being put up for sale; and the ascertained value is added to the upset price.

No person can sue before a warden, or in any courts, to recover possession of any land, claim, share, &c., held by virtue of a Miner's Right, unless he was himself in

possession of such a document, or included in a consolidated right at the time his alleged title first accrued.

The Governor is empowered, by the Act, to grant leases and licenses for mining purposes.

The rents for gold-mining leases are fixed by the regulations at £1 sterling per acre per annum; for other mineral leases, at 2*s.* per acre per annum, and two per cent. on the value of the mineral or metal, at the mouth of the mine; the fee for searching licenses is at the rate of £10 per annum, sterling, for every square mile so taken up.

Special leases for gold mining purposes may be granted of area not exceeding 100 acres, at a nominal rent, to the discoverers of new gold-fields.

The Colony is at present divided into seven mining districts, viz., Ballarat, Sandhurst, Castlemaine, Maryborough, Beechworth, Gippsland, and Ararat, and in each there is a legislative body, termed a Mining Board. The members (ten for each board) are elected by ballot; and each *male* holder of a Miner's Right is allowed to vote. The members hold office for twelve months, and are paid at the rate of £50 per annum each. These Boards possess large powers, which are named in the Act.

Each district has its separate Court of Mines, which is a court of record, and is presided over by a district judge, who must be a barrister of not less than eight years' standing. There is also one of the supreme court judges appointed to act as chief judge of the Court of Mines.

The Courts of Mines have jurisdiction to hear and determine "all suits cognisable by a court of law, or by a court of equity, which may arise concerning any crown land claimed under miner's rights, business licenses or leases," mining partnerships, boundaries, contribution to calls, and generally all questions and

disputes which may arise between miners in relation to mining upon crown lands." These courts possess the necessary staff of clerks and bailiffs, whose several duties are defined by the statute; and, under its provisions, miners and representatives may sue and be sued, and the court can make an order requiring a warden, surveyor, and other officer to perform the duties of his office, and may obtain the assistance of accountants, inquirers, and other scientific persons.

The wardens on the gold-fields, of whom there are forty, receive their appointment from the Governor in Council. The duties are mostly of a judicial character, and they act generally, also, as police magistrates.

As wardens, they hear and determine all suits, cognisable by a court of law, which the Courts of Mines are empowered to hear, and also they may proceed summarily to settle any dispute concerning any crown land, share, or interest in any claim.

The mode of procedure before a warden, in the first instance, is to take out a summons (cost, 2s. 6d.); this brings the case on for hearing, which is conducted in a manner very similar to cases brought before justices in petty session. The warden has to keep a record or register of all complaints and decisions, a copy of which must be furnished to persons interested, if demanded. Cases may be tried before assessors, if desired, on payment of £2 for assessor's fees.

The wardens forward to the Mining Department monthly reports of their districts, and receive, investigate, and report upon all applications for leases. The mining surveyors, fifty-three in number, survey the ground applied for under lease, and report to the Minister of Mines.

Officers are appointed by the Governor in Council, called Mining Registrars, of whom there are fifty; they

keep a record of all claims held under Miners' Rights, and issue certificates of title, make all transfers of sales of shares, and report quarterly to the Mining Department on the condition of the mines in their several divisions.

The mines of the Colony are placed under a Mining Department, whose head has a seat in the Legislative Assembly, and in the Cabinet.

RECAPITULATION.

I have given, in the foregoing, a short history of the discovery of gold in Victoria, and have shown—

That the area in Victoria, composed of the upper and lower Silurian rocks, is 30,348 square miles.

That of this area (the whole of which may be auriferous) only $\frac{1}{33}$ has been proved to contain gold.

That of the "tried ground," only $\frac{1}{6}$ (or $\frac{1}{200}$ of the probable golden ground) is occupied.

That mining for gold is a profitable employment.

That the mines of Victoria have been subjected to great mismanagement.

That, if properly superintended, the result of mining for gold throughout the Colony will be fully 100 per centum profit per annum to the investors.

That *quartz* mining is a much more profitable speculation than *alluvial* mining (except, of course, where a miner is fortunate enough to obtain a claim on a *known lead*, in which case the accumulation of a fortune is only a question of time).

That no doubt can exist as to the permanence of our quartz veins; instances having been cited of the *downward* continuation of the golden ores, from localities as far apart as the opposite boundaries of the colony, and, if

this were not sufficient, California gives corroborative evidence.

That the Government of Victoria gives every encouragement for the safe investment of capital in the mines by foreign capitalists, making provision for the transaction of business through Agents.

That the tenure is safe; the crown being the lessor.

That there are so many openings for the investment of capital in Victoria in other ways, that the local banks can spare but little money for the advancement of mining

That by the systematic carrying on of mining in Victoria by the aid of English capital, England may be relieved of numbers of her straightened mining population. (The writer had great difficulty in obtaining the services of good miners to work a mine of his own, before he left the Colony).

In conclusion, I may state that I deprecate criticism on the *manner* of the compilation of this pamphlet, but court inquiry as to the *matters of fact* herein contained.

I am prepared to produce copies of the *Mining Statute* of Victoria (Act 29 Vict. No. 291), *Regulations relating to Mining Leases, Mineral Leases, "Water Right" Licenses,* &c., as also the *Mineral Statistics* of Victoria for the year 1866, as presented to both Houses of Parliament (Victoria). I am also prepared to show how capital can be safely invested in Victoria in connection with the mines, so as to give dividends from the outset.

Vickers & Harrington, Printers, 7, Mark Lane, E.C., and 2, Cowper's Court Cornhill.

(Nov., 1891, 20,000)

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